MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2015/2016

PDS0101 – INTRODUCTION TO DIGITAL SYSTEMS

(All sections / Groups)

29 February 2016
9.00 am - 11.00 am
(2 Hours)

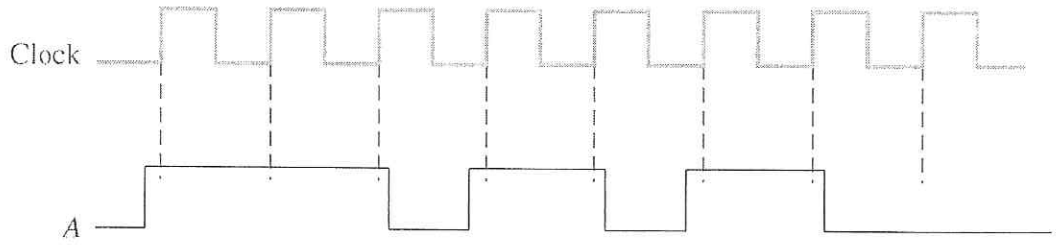
INSTRUCTIONS TO STUDENTS

1. This Question paper consists of 3 pages with 5 Questions. Please attempt **ALL** questions.
2. The total marks for this paper is 50 marks and the distribution of the marks for each question is given.

3. Please print all your answers in the Answer Booklet provided.

QUESTION 1

a) Referring to the square waveform "A" shown below, answer the questions that follow. **[4 Marks]**



i. Determine whether the waveform is periodic or non-periodic. State your reason.
ii. Indicate the sequence of bits transferred if a bit is read upon the clock's rising edge.
iii. What is the time required to send one (1) bit if given the reference clock is running at 400KHz?
iv. Calculate the total time required to send the bits you determined in (ii).

b) Calculate $(A3)_{16} + (1010)_2$ and give your answer in octal base 8. **[3 Marks]**

c) Perform the calculation of $(6B)_{16} - (56)_8$ using 8-bits signed 2's complement binary numbers and give your answer in decimal. **[3 Marks]**

QUESTION 2

a) Prove that $A + \overline{A}B = A + B$ by using Boolean algebra rules. **[3 Marks]**

b) It is given that $X = (A + B)C + B$. Find the output of X for the following truth table.

A	B	C
0	0	0
0	0	1
0	1	0
0	1	1
1	0	0
1	0	1
1	1	0
1	1	1

[3 Marks]

c) By applying Boolean rules and theorems, simplify the given expression X, and then draw the logic circuit for the simplified X. **[4 Marks]**

$$X = (\overline{AB} + \bar{C})(\overline{\bar{B} + D})$$

Continued ...

QUESTION 3

a) Derive the Boolean expression of W in standard Sum of Products (SOP) format for the given truth table. **[3 Marks]**

Input			Output
A	B	C	W
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	0
1	1	1	0

b) Apply K-map to minimize the Boolean expression into SOP form and draw the simplified circuit. **[3 Marks]**

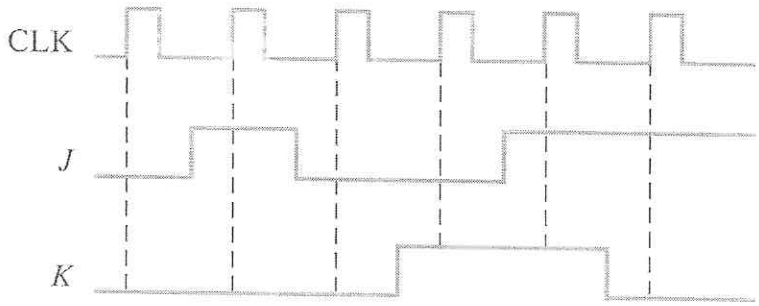
c) Construct a truth table for the Boolean expression T. By applying Boolean rules and theorems, simplify the given expression T. **[4 Marks]**

$$T = (\overline{AC} + B)(\bar{A})$$

QUESTION 4

a) Design a 3-bit parallel adder by using a half adder and two full adders, where carry output is represented by C_o and sum of each bit adder is represented by $\sum_1$, $\sum_2$ and $\sum_3$. **[3 Marks]**

b) For a positive edge triggered J-K flip-flop with inputs as shown below, determine the Q(normal) output relative to the CLK assuming that Q is initially LOW. **[3 Marks]**



c) Draw the logic circuit diagram for a 3-bit serial in/parallel out shift register. **[4 Marks]**

Continued ...

QUESTION 5

Design a synchronous counter using JK flip-flops that follows the sequence 000,001,010,011,100 and repeats. The undesired states go to 000 on the next clock pulse.

a) Construct the state diagram for the needed counter. **[2 Marks]**

b) Create the next state table according to the state diagram in (a) **[2 Marks]**

c) Define the J and K inputs for each flip-flop involved in the counter. **[2 Marks]**

d) Perform K-map simplification for each of the flip-flops in the counter. **[2 Marks]**

e) Implement the final expressions as combinational logic with flip-flops to complete the design of the counter. **[2 Marks]**

End of Exam